GeoReport

VA Baton Rouge National Cemetery
Baton Rouge, Louisiana

September 16, 2015

Terracon Project No. EH155138

Prepared for:

FourFront Design, Inc.

Rapid City, South Dakota

Prepared by:

Terracon Consultants, Inc.

Baton Rouge, Louisiana

Terracon GeoReport

September 16, 2015

FourFront Design, Inc.
517 Seventh Street
Rapid City, South Dakota 57701

Attn: Mr. Terry Cash
E: tcash@4FRONT.biz

Re: Geotechnical Engineering Report
VA Baton Rouge National Cemetery
Baton Rouge, Louisiana
Terracon Project Number: EH155138

Dear Mr. Cash:

We have completed the geotechnical engineering services for the above-referenced project. This work was performed in accordance with our proposal number PEH150101 dated March 9, 2015.

This report presents the findings of the subsurface exploration and provides geotechnical recommendations concerning earthwork and site preparation for pavement and drainage improvements for the proposed project.

We should collaborate with you as you finalize the designs. We should also review the pertinent aspects of the plans and specifications and provide construction materials and engineering testing services when the project moves into construction.

Sincerely,
Terracon Consultants, Inc.

STATE OF LOUISIANA
REBECCA S. CHATAGNIER
License No. 36885
PROFESSIONAL ENGINEER
IN
CIVIL ENGINEERING

Rebecca S. Chatagnier, P.E.
Project Engineer

Stephen E. Greaber, P.E.
Principal

Enclosure

Terracon Consultants, Inc. 2822 O'Neal Lane Building B Baton Rouge, Louisiana 70816
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Environmental ■ Facilities ■ Geotechnical ■ Materials

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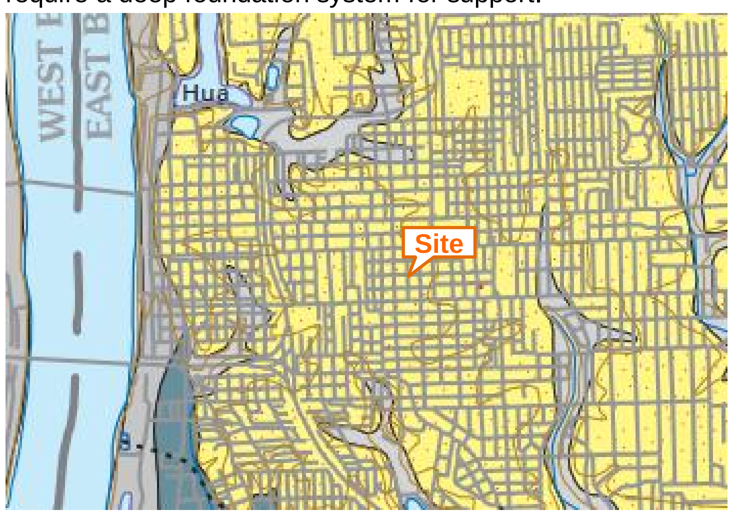
PROJECT DESCRIPTION

Our initial understanding of the project was provided in our Stage 1 submittal in **Project Understanding**. During the period of collaboration that has transpired since the project was initiated, our understanding of the project conditions has been modified to reflect the following.

ITEM	DESCRIPTION
Project Location	Baton Rouge National Cemetery 220 North 19th Street in Baton Rouge Louisiana (See **Site Location**).
Proposed Structure	The project will include replacing and repairing the roads and storm drainage system at the Baton Rouge National Cemetery. The existing road will reportedly be milled and overlaid with 2 inches of asphalt surfacing, the storm drainage pipes and catch basins/manholes will be repaired, and deteriorated curb and gutters will be replaced.
Grading/Slopes	No grade change is anticipated.
Below grade construction	Installation and repair of storm drainage catch basins and pipes.

SITE CONDITIONS

The following description of site conditions is derived from our site visit in association with the field exploration and our review of local, publically available geology and topographic maps.

ITEM	DESCRIPTION
Parcel Information	Off 220 North 19th Street (Baton Rouge National Cemetery) in Baton Rouge, Louisiana. See **Site Location**
Existing improvements	Existing pavements and cemetery.
Current ground cover	Pavement.
Existing topography	Relatively flat. Approximate Elevation +50 to +51 feet Mean Sea Level (MSL)
Geologic setting	The property is located within an area of Prairie Terrace deposits (Pph) of Pleistocene age. These deposits typically consist of silty clays and clays with some sand layering. They usually provide good foundation support for relatively light to moderately loaded structures. Heavy structures typically require a deep foundation system for support.  (Baton Rouge 30 x 60 Minute Geologic Quadrangle, 2000)

GEOTECHNICAL MODEL AND GROUNDWATER CONDITIONS

The following table provides a generalized summary of soil conditions.

STRATUM	TYPICAL STRATUM BASE (FEET)	MATERIAL DESCRIPTION	CONSISTENCY/DENSITY
Surface	0.1	1 to 1.5 inches Asphalt	N/A
Base	0.5	6 to 7 inches Concrete	N/A
1	0.5 to 15	Lean clay with silt	Medium stiff to Very stiff
Notable Variations	At Boring B-02 a very stiff Fat clay (CH) layer was present from 2 to 4 feet At Boring B-05 a very stiff Fat Clay (CH) layer was present from 11 to 13 feet.		

The table includes generalizations and does not reflect specific conditions at each exploration point. Conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate location of changes in soil types; in situ, the transition between materials may be gradual. Details for each of the borings and can be found on the boring logs in Appendix A of this report.

Groundwater Conditions

Groundwater was not observed in the borings while drilling or for the short duration that the borings were allowed to remain open. However, this does not necessarily mean these borings terminated above groundwater. Due to the low permeability of the soils encountered in the borings, a relatively long period of time may be necessary for the groundwater level to develop and stabilize in a borehole in these materials. Long term observations in piezometers or observation wells sealed from the influence of surface water are often required to define the field or in-situ groundwater level in materials of this type.

Groundwater level fluctuations occur due to seasonal variations in the amount of rainfall, runoff, and other factors that are not evident at the time of drilling. Therefore, the groundwater levels that may prevail during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing the design and construction plans for this project.

EXPLORATION AND TESTING PROCEDURES

Field Exploration

Our field exploration work included the drilling and sampling of exploratory soil borings consistent with the following schedule.

Number of Borings	Boring Depth	Planned Location
3	15	Pavement

The locations of field exploration points were established in the field by Terracon's exploration team using a hand-held GPS unit to establish boring locations with reference to known points. The accuracy of the exploration points is usually within 10 feet of the noted location. The ground surface elevations are estimated from the most recent USGS topographic maps, and the accuracy of the ground surface at each point is probably about 2 feet.

We cored through the existing pavement and base with a diamond tip core barrel and measured the thickness of the existing roadway pavement section. We then advanced soil borings with a track-mounted drill rig using continuous flight augers (solid stem). We obtained thin-walled tube samples to secure relatively undisturbed samples. Shelby tube samples were obtained hydraulically pushing a seamless steel tube with a sharpened cutting edge into the boring to obtain a relatively undisturbed sample of cohesive soil. We reported the sampling depths, penetration distances, and the standard penetration resistance values on the boring logs. In the field, we placed the samples into containers, seal them, and return them to the laboratory for observation, testing and classification.

Our exploration team prepared field boring logs as part of the drilling operations. These field logs include visual classifications of the materials encountered during drilling and our interpretation of the subsurface conditions between samples. Final boring logs were prepared from the field logs. The final boring logs represent the engineer's interpretation of the field logs and include modifications based on observations and tests of the samples in the laboratory.

Laboratory Testing

The project engineer reviewed the field data and assigned various laboratory tests to better understand the engineering properties of the various soil strata as necessary for this project. Procedural standards noted below are for reference to methodology in general. In some cases, variations to methods are applied as a result of local practice or professional judgment. Standards noted below include reference to other, related standards. Such references are not necessarily applicable to describe the specific test performed.

- ASTM D2216-10 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
- ASTM D4318-10e1 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
- ASTM D2166/D2166M-13 Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

The laboratory testing program may often include examination of soil samples by an engineer. Based on the material's texture and plasticity, we describe and classify the soil samples in accordance with the *Unified Soil Classification System*.

SITE CLASSIFICATION FOR SEISMIC DESIGN

Design of buildings and other structures subject to earthquake ground motions requires classification of the upper 100 feet of the site profile in accordance with Chapter 20 of ASCE 7. The Site Class types are listed below and are basically defined by an average value of either shear wave velocity, standard penetration resistance, or undrained shear strength.

- A. Hard Rock
- B. Rock
- C. Very dense soil and soft rock
- D. Stiff soil
- E. Soft clay soil
- F. Soils vulnerable to potential failure or collapse under seismic loading

Based on the results of our site characterization program, we conclude that Site Class D is appropriate for the subject site. Note that the scope of services did not include site profile determination to a depth of 100 feet. Explorations for this project extended to a maximum depth of 15 feet and the site classification assumes that materials encountered at the bottom of the deepest exploration continue to a depth of 100 feet. We expect that the soil conditions below the maximum explored depth are consistent with the Site Class noted for this site.

SITE PREPARATION

Terracon, in collaboration with the design team, has developed a specification for the following aspects of site preparation:

- Excavations
- Utility Repair and Replacement
- Pavement Rehabilitation

Our recommended site preparation specifications are included in this GeoReport. These specifications include critical quality criteria as necessary to render the site in the state anticipated by our geotechnical engineering for drainage utilities and pavements.

Minimal site grading activities are planned and no change in grade is anticipated. Therefore site preparation activities should be minimal. To the extent possible, effective drainage should be maintained throughout the site preparation and construction process. This is particularly important if any aspects of construction are attempted during wet periods.

Excavations

The soil conditions were generally consistent along the roadway alignment. Stiff to very stiff lean and fat clays were present at the boring locations. Existing storm water structures and pipes are located along the existing alignment. Granular bedding and backfill material may be present around the existing structures and trapped water may be present. This should be anticipated during construction. If trapped water is encountered, the contractor should be prepared to remove seepage water from the excavation using sump pumps. Trapped water may also be present under existing roadways in the roadway base or subgrade material. Contractor should anticipate seepage of the trapped water during excavations.

Excavations up to 4 feet placed in the clays should typically stand on near vertical slopes for short-term conditions during construction. Areas where sand layers are encountered or for excavations that will stay open for extended periods will require sloping or shoring to prevent sloughing during construction.

As a minimum, excavations greater than 4 feet should be performed in accordance with OSHA 29 CFR, Part 1926, Subpart P, "Excavations" and its appendices, and in accordance with any applicable local, state, and federal safety regulations. The contractor should be aware that slope height, slope inclination, and excavation depth should in no instance exceed those specified by these safety regulations. Flatter slopes than those dictated by these regulations may be required depending upon the soil conditions encountered and other external factors. These regulations are strictly enforced and if they are not followed, the owner, contractor, and/or earthwork and utility subcontractor could be liable and subject to substantial penalties. The contractor should select an excavation design/protocol that satisfies the regulations, city-parish specifications, site constraints and their interpretations of soil conditions from boring logs.

The groundwater table was not encountered at the time the borings were drilled. However, it should be anticipated that the groundwater table could rise and affect excavation efforts. A temporary dewatering system consisting of sumps with pumps could be necessary to achieve the required depth of excavation.

Fill Types

The soil borings indicate that stiff clays are anticipated at the base of the planned excavations. This material is subject to water softening if storm water or groundwater is allowed to remain in the excavation for extended time periods. Care should be exercised to minimize the retention of free water in the excavations.

Bedding Material

Before bedding material is placed in the excavation, the excavation base should be inspected for stability. If the excavation base is stable, a 6 inch layer of sand-aggregate mixture in general accordance with the gradation in Section 1001-9 of the EBR Standard Specifications and Plans is recommended for use as a bedding layer.

If the base is unstable, the unstable material should be removed to a maximum depth of 3 feet below the structure or pipe bottom. Per EBR Standard Specifications and Plans, a nonwoven geotextile fabric should be placed in the excavation and backfilled with a No. 57 or 67 limestone material. The fabric and limestone material should be in general accordance with Section 801-3 of the EBR Standard Specifications and Plans.

Initial Backfill

Subsequent to placement of the pipe, initial backfill material should be placed to 12 inches above the top of the pipe. This material should consist of sand-aggregate mixture in general accordance with the gradation requirements in Section 1001-9 of the EBR Standard Specifications and Plans.

Final Backfill

Final backfill material for trenches in unimproved areas should consist of useable soils derived from the excavations. Per EBR Standard Specifications, Useable Excavated Soils should have a maximum plasticity index of 25 and a maximum organic content of 5 percent as per Section 801-3 of the EBR Standard Specifications and Plans. Some of the lean clay encountered at the borings in these alignments are considered acceptable for use as Useable Excavated Soils, but may require blending and processing by the contractor to provide consistent useable material.

Per EBR Specifications the final backfill material should be selected based upon the planned surface loading/uses. For example, if the trench is located within an asphalt pavement, concrete pavement, or granular road surface, the upper three feet of final backfill should consist of compacted stone in accordance with Section 801-3 of EBR Specifications and Plans.

Compaction Requirements

Engineered fill should meet the following compaction requirements:

ITEM	DESCRIPTION
Fill Lift Thickness	9 inches or less in loose thickness when heavy, self-propelled compaction equipment is used 4 to 6 inches in loose thickness when hand-guided equipment (i.e. jumping jack or plate compactor) is used
Compaction Requirements [1]	Minimum 95% of the standard Proctor maximum dry density (ASTM D 698)
Moisture Content of Cohesive Soil	Within the range of 2% below to 2% above the optimum moisture content value as determined by the standard Proctor test at the time of placement and compaction with stability present.
Moisture Content of Granular Material [2]	Workable moisture levels

1. The moisture content and compaction should be measured for each lift of engineered fill during placement. Should the results of the in-place density tests indicate the specified moisture or compaction limits have not been met, the area represented by the test should be reworked and retested as required until the specified moisture and compaction requirements are achieved.
2. Specifically, moisture levels should be maintained low enough to allow for satisfactory compaction to be achieved without the cohesionless fill material pumping when proofrolled.

Fill Construction Observation and Testing

Each lift of compacted fill should be tested, evaluated, and reworked, as necessary, until approved by the geotechnical engineer's representative prior to placement of additional lifts. We recommend that each lift of fill be tested for density and moisture content at a frequency of one test for every 5,000 square feet in pavement areas. We recommend one density and moisture content test for every 50 linear feet of compacted utility trench backfill

Earthwork Construction Considerations

Construction site safety is the sole responsibility of the contractor who controls the means, methods and sequencing of construction operations. Under no circumstances shall the information provided herein be interpreted to mean that Terracon is assuming any responsibility for construction site safety or the contractor's activities; such responsibility shall neither be implied nor inferred.

Terracon should be retained during the construction phase of the project to observe earthwork and to perform necessary tests and observations during subgrade preparation; proofrolling; placement and compaction of controlled compacted fills; backfilling of excavations into the completed subgrade, and just prior to construction of pavements or bases.

Milling and Overlay

Prior to implementation of the milling and overlay process, a proof-roll of the existing pavement surface should be performed to verify the relative stability of the pavements and to observe for the presence of any weak, yielding or pumping base. The proof-roll should be performed with a loaded heavy tandem axle dump truck weighing at least 25 tons

Areas that currently show base failure and any unstable areas identified during the proof-roll should be over excavated and replaced with a full depth asphalt patch. Large areas can be reconstructed with a minimum 6 inches of compacted No. 610 limestone base.

After the proof-roll is completed and after milling, the exposed asphalt or concrete should be inspected for cracks. All cracks should be properly cleaned and sealed with asphalt bitumen to minimize reflective cracking. Even with the recommended sealing, the occurrence of some reflective cracking should be anticipated with an overlay program.

PROJECT CONSIDERATIONS

Our work is conducted with the understanding of the project as noted in **Project Description**. Verification of any stated assumptions and revision of our understanding to reflect actual conditions is important to our work, and the design team should collaborate with Terracon to confirm this understanding.

The design team should collaborate with Terracon to prepare the final design plans and specifications. This facilitates the incorporation of our opinions related to implementation of our geotechnical recommendations.

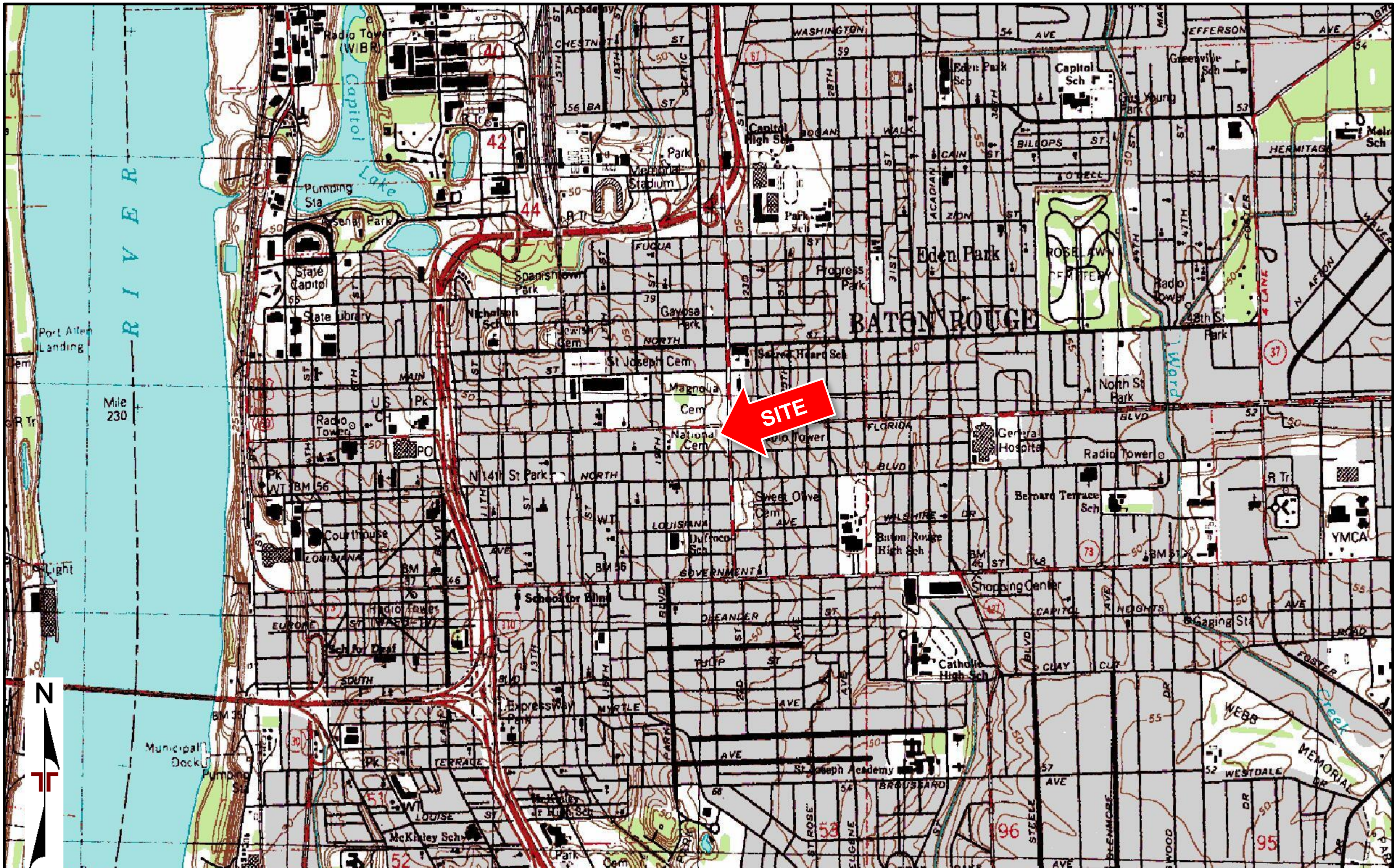
Our analysis and opinions are based upon our understanding of the geotechnical conditions in the area, the data obtained from the site exploration performed and from our understanding of the project. Variations will occur between exploration point locations, across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. So, Terracon should be retained to provide observation and testing services during grading, excavation, foundation construction and other earth-related construction phases of the project. If variations appear, we can provide further evaluation and supplemental recommendations. If variations are noted in the absence of our observation and testing services on-site, we should be immediately notified so that we can provide evaluation and supplemental recommendations.

Our scope of services does not include either specifically or by implication any environmental or biological (e.g., mold, fungi, bacteria) assessment of the site or identification or prevention of pollutants, hazardous materials or conditions. If the owner is concerned about the potential for such contamination or pollution, other studies should be undertaken.

Our services and any correspondence are intended for the exclusive use of our client for specific application to the project discussed and are accomplished in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made.

Site characteristics as provided are for design purposes and not to estimate excavation cost. Any use of our report in that regard is done at the sole risk of the excavating cost estimator as there may be variations on the site that are not apparent in the data that could significantly impact excavation cost. Any parties charged with estimating excavation costs should seek their own site characterization for that specific purposes to obtain the specific level of detail necessary for costing. Site safety, and other cost estimating including, excavation support, and dewatering requirements are the responsibility of others. In the event that changes in the nature, design, or

APPENDIX A
EXPLORATION AND LABORATORY RESULTS



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY QUADRANGLES INCLUDE: BATON ROUGE WEST, LA (1/1/1995).

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

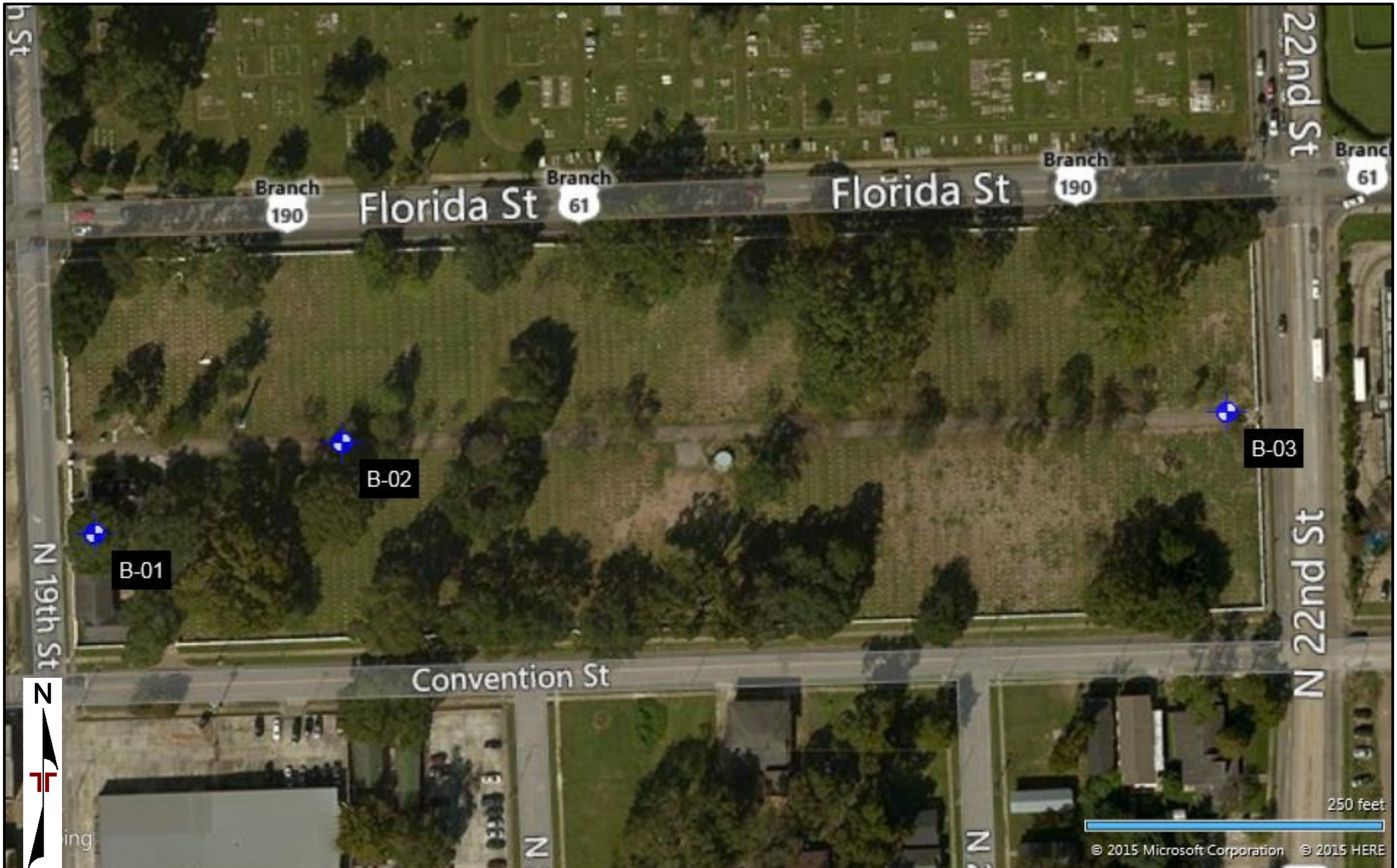
Project Manager: RSC	Project No. EH155138
Drawn by: JMV	Scale: 1"=24,000 SF
Checked by: RSC	File Name: A-1
Approved by: RSC	Date: 8/31/2015

Terracon
2822 O'Neal Lane Bldg B
Baton Rouge, LA 70816

SITE LOCATION

Baton Rouge National Cemetery
220 North 19th Street
Baton Rouge, LA

Exhibit
A-1



AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: RSC	Project No. EH155138
Drawn by: JMV	Scale: AS SHOWN
Checked by: RSC	File Name: A-2
Approved by: RSC	Date: 8/31/2015

Terracon
2822 O'Neal Lane Bldg B
Baton Rouge, LA 70816

EXPLORATION PLAN

Baton Rouge National Cemetery
220 North 19th Street
Baton Rouge, LA

Exhibit
A-2

BORING LOG NO. B-01

PROJECT: Baton Rouge National Cemetary

**CLIENT: FourFront Design, Inc.
Rapid City, SD**

**SITE: 220 North 19th Street
Baton Rouge, LA**

LOCATION See Exhibit A-2

Latitude: 30.44917° Longitude: -91.16912°

Approximate Surface Elev: 54 (Ft.) +/-

DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
0.1	**1 to 1.5" ASPHALT**	54+/-										
0.6	**6" CONCRETE**	53.5+/-										
	LEAN CLAY WITH SILT (CL), gray and tan, stiff, with ferrous nodules, shells					1.00 (HP)				18	108	28-16-12
						1.50 (HP)	UC	1.68	10.3	24	98	
			5			2.00 (HP)	UC	1.20	9.6	21	103	35-22-13
	medium stiff					0.75 (HP)						
						0.50 (HP)	UC	0.73	14.6	23	103	31-16-15
			10									
						1.50 (HP)						
						1.75 (HP)						
15.0		39+/-	15									
	Boring Terminated at 15 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 - 0.6' drill bit
0.6' - 15.6' short flight auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion. Sealed with bituminous cold patch at surface.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
2822 O'Neal Lane, Building B
Baton Rouge, Louisiana

Boring Started: 8/27/2015	Boring Completed: 8/27/2015
Drill Rig: ATV	Driller: G. Triplette
Project No.: EH155138	Exhibit: A-3

BORING LOG NO. B-02

PROJECT: Baton Rouge National Cemetary

CLIENT: FourFront Design, Inc. Rapid City, SD

SITE: 220 North 19th Street Baton Rouge, LA

LOCATION See Exhibit A-2

Latitude: 30.44938° Longitude: -91.16846°

Approximate Surface Elev: 51 (Ft.) +/-

DEPTH	Description	ELEVATION (Ft.)	DEPTH (Ft.)	WATER LEVEL OBSERVATIONS	SAMPLE TYPE	FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
0.1	**1 to 1.5" ASPHALT**	51+/-										
0.7	**7" CONCRETE**	50.5+/-										
	LEAN CLAY WITH SILT (CL), silty, brown, very stiff, with ferrous nodules					2.50 (HP)				18		
2.7		48.5+/-				3.00 (HP)				25	98	50-21-29
	FAT CLAY (CH), tan, very stiff, with ferrous nodules											
4.7		46.5+/-										
	LEAN CLAY WITH SILT (CL), tan to gray and tan, stiff, with ferrous nodules		5			2.50 (HP)	UC	1.77	6.3	23	99	
						1.75 (HP)	UC	1.27	8.3	23	102	22-13-9
						2.00 (HP)						
			10									
						1.00 (HP)	UC	1.02	14.4	23	87	30-22-8
						1.25 (HP)						
15.0		36+/-	15									
	Boring Terminated at 15 Feet											

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 - 0.7' drill bit
0.7' - 15.7' short flight auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion. Sealed with bituminous cold patch at surface.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
2822 O'Neal Lane, Building B
Baton Rouge, Louisiana

Boring Started: 8/27/2015	Boring Completed: 8/27/2015
Drill Rig: ATV	Driller: G. Triplette
Project No.: EH155138	Exhibit: A-4

BORING LOG NO. B-03

PROJECT: Baton Rouge National Cemetary

CLIENT: FourFront Design, Inc.
Rapid City, SD

SITE: 220 North 19th Street
Baton Rouge, LA

LOCATION See Exhibit A-2

Latitude: 30.44945° Longitude: -91.1661°

Approximate Surface Elev: 46 (Ft.) +/-

DEPTH	MATERIAL DESCRIPTION	ELEVATION (Ft.)
0.1	**1 to 1.5" ASPHALT**	46+/-
0.6	**6" CONCRETE**	45.5+/-
11.6	**LEAN CLAY WITH SILT (CL)**, gray and tan, stiff, with ferrous nodules	34.5+/-
13.6	**FAT CLAY (CH)**, gray and tan, stiff to very stiff	32.5+/-
15.0	**SILTY CLAY (CL-ML)**, tan, soft	31+/-
	Boring Terminated at 15 Feet	

FIELD TEST RESULTS	STRENGTH TEST: TEST TYPE	STRENGTH TEST: COMPRESSIVE STRENGTH (tsf)	STRENGTH TEST: STRAIN (%)	WATER CONTENT (%)	DRY UNIT WEIGHT (pcf)	ATTERBERG LIMITS LL-PL-PI
1.00 (HP)				30		
1.25 (HP)				26	95	40-22-18
1.00 (HP)	UC	1.25	8.5	23	103	
1.00 (HP)	UC	1.42	12.7	22	104	33-24-9
1.00 (HP)						
1.50 (HP)	UC	2.79	15	18	108	60-16-44
--						

DEPTH (Ft.): 5, 10, 15

Stratification lines are approximate. In-situ, the transition may be gradual.

Advancement Method:
0 - 0.6' drill bit
0.6' - 15.6' short flight auger

Abandonment Method:
Borings backfilled with soil cuttings upon completion. Sealed with bituminous cold patch at surface.

See Exhibit A-3 for description of field procedures.

See Appendix B for description of laboratory procedures and additional data (if any).

See Appendix C for explanation of symbols and abbreviations.

Notes:

WATER LEVEL OBSERVATIONS

No free water observed

Terracon
2822 O'Neal Lane, Building B
Baton Rouge, Louisiana

Boring Started: 8/27/2015	Boring Completed: 8/27/2015
Drill Rig: ATV	Driller: G. Triplette
Project No.: EH155138	Exhibit: A-5

APPENDIX B
SUPPORTING DOCUMENTS

GENERAL NOTES

DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

SAMPLING

- Auger
- Split Spoon
- Shelby Tube
- Macro Core
- Ring Sampler
- Rock Core
- Grab Sample
- No Recovery

WATER LEVEL

- Water Initially Encountered
- Water Level After a Specified Period of Time
- Water Level After a Specified Period of Time

Water levels indicated on the soil boring logs are the levels measured in the borehole at the times indicated. Groundwater level variations will occur over time. In low permeability soils, accurate determination of groundwater levels is not possible with short term water level observations.

FIELD TESTS

(HP)	Hand Penetrometer
(T)	Torvane
(b/f)	Standard Penetration Test (blows per foot)
(PID)	Photo-Ionization Detector
(OVA)	Organic Vapor Analyzer

DESCRIPTIVE SOIL CLASSIFICATION

Soil classification is based on the Unified Soil Classification System. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; their principal descriptors are: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are principally described as clays if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse-grained soils are defined on the basis of their in-place relative density and fine-grained soils on the basis of their consistency.

LOCATION AND ELEVATION NOTES

Unless otherwise noted, Latitude and Longitude are approximately determined using a hand-held GPS device. The accuracy of such devices is variable. Surface elevation data annotated with +/- indicates that no actual topographical survey was conducted to confirm the surface elevation. Instead, the surface elevation was approximately determined from topographic maps of the area.

STRENGTH TERMS

RELATIVE DENSITY OF COARSE-GRAINED SOILS (More than 50% retained on No. 200 sieve.) Density determined by Standard Penetration Resistance Includes gravels, sands and silts.			CONSISTENCY OF FINE-GRAINED SOILS (50% or more passing the No. 200 sieve.) Consistency determined by laboratory shear strength testing, field visual-manual procedures or standard penetration resistance			
Descriptive Term (Density)	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**	**Descriptive Term (Consistency)**	**Unconfined Compressive Strength, Qu, tsf**	**Standard Penetration or N-Value Blows/Ft.**	**Ring Sampler Blows/Ft.**
Very Loose	0 - 3	0 - 6	Very Soft	less than 0.25	0 - 1	< 3
Loose	4 - 9	7 - 18	Soft	0.25 to 0.50	2 - 4	3 - 4
Medium Dense	10 - 29	19 - 58	Medium-Stiff	0.50 to 1.00	4 - 8	5 - 9
Dense	30 - 50	59 - 98	Stiff	1.00 to 2.00	8 - 15	10 - 18
Very Dense	> 50	≥ 99	Very Stiff	2.00 to 4.00	15 - 30	19 - 42
			Hard	> 4.00	> 30	> 42

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component of Sample	Particle Size
Boulders	Over 12 in. (300 mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75 mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) of other constituents	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

PLASTICITY DESCRIPTION

Term	Plasticity Index
Non-plastic	0
Low	1 - 10
Medium	11 - 30
High	> 30

Terracon

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests [A]				Soil Classification: Group Symbol	Soil Classification: Group Name [B]
Coarse Grained Soils: More than 50% retained on No. 200 sieve	**Gravels:** More than 50% of coarse fraction retained on No. 4 sieve	**Clean Gravels:** Less than 5% fines [C]	$Cu \geq 4$ and $1 \leq Cc \leq 3$ [E]	GW	Well-graded gravel [F]
			$Cu < 4$ and/or $1 > Cc > 3$ [E]	GP	Poorly graded gravel [F]
		Gravels with Fines: More than 12% fines [C]	Fines classify as ML or MH	GM	Silty gravel [F,G,H]
			Fines classify as CL or CH	GC	Clayey gravel [F,G,H]
	Sands: 50% or more of coarse fraction passes No. 4 sieve	**Clean Sands:** Less than 5% fines [D]	$Cu \geq 6$ and $1 \leq Cc \leq 3$ [E]	SW	Well-graded sand [I]
			$Cu < 6$ and/or $1 > Cc > 3$ [E]	SP	Poorly graded sand [I]
		Sands with Fines: More than 12% fines [D]	Fines classify as ML or MH	SM	Silty sand [G,H,I]
			Fines classify as CL or CH	SC	Clayey sand [G,H,I]
Fine-Grained Soils: 50% or more passes the No. 200 sieve	**Silts and Clays:** Liquid limit less than 50	**Inorganic:**	$PI > 7$ and plots on or above "A" line [J]	CL	Lean clay [K,L,M]
			$PI < 4$ or plots below "A" line [J]	ML	Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OL	Organic clay [K,L,M,N]
					Organic silt [K,L,M,O]
	Silts and Clays: Liquid limit 50 or more	**Inorganic:**	PI plots on or above "A" line	CH	Fat clay [K,L,M]
			PI plots below "A" line	MH	Elastic Silt [K,L,M]
		Organic:	Liquid limit - oven dried / Liquid limit - not dried < 0.75	OH	Organic clay [K,L,M,P]
					Organic silt [K,L,M,Q]
Highly organic soils:	Primarily organic matter, dark in color, and organic odor			PT	Peat

[A] Based on the material passing the 3-inch (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains $\geq$ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains $\geq$ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains $\geq$ 30% plus No. 200 predominantly sand, add "sandy" to group name.

[M] If soil contains $\geq$ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] $PI \geq 4$ and plots on or above "A" line.

[O] $PI < 4$ or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.